

Claim 1. (Currently Amended) A method for manufacturing a cylindrical, partly cylindrical or hollow cylindrical surface-alloyed structural member made from a matrix alloy where an energy beam having a linear focus, is directed onto a workpiece surface of a workpiece being moved in front of said energy beam to form a zone of incidence on said workpiece surface wherein the workpiece surface is melted forming a liquified matrix alloy ~~and silicon powder is fed into the molten surface~~, said method comprising:

a) forming a locally bounded melting bath in which the liquified matrix alloy is present in the zone of incidence of the energy beam, the melting bath having a heating front, a melting front, a solution zone and a solidification front,

b) depositing the silicon powder at the side of the energy beam via a conveyor device in the direction of gravity and supplying said silicon powder in coordination with the feed movement of the workpiece in a width which corresponds to the width of the linear focus and producing thereby a layer of silicon powder having a height of 0.3 - 3 mm,

c) heating the silicon powder supplied to the workpiece surface in the heating front of the melting bath with the energy beam at a wavelength of 780 - 940 nm and thereby dissolving in the melting bath the silicon powder which is in contact with the liquefied matrix alloy,

d) producing convection in the solution zone with the energy beam having a specific power of at least 10^4 W/cm^2 , so that the homogenization process in the melting bath is accelerated,

e) wherein the linear focus acts on the solution zone until the silicon powder is uniformly distributed in the melting bath,

f) subjecting the uniformly distributed silicon powder in front of the energy beam, which has gone into solution metallurgically in the solution zone, to directional solidification in the solidification front at a cooling rate of 200 - 600 K/sec wherein the workpiece is moved at a feed rate of 500 - 10,000 mm/min.

2. (Previously Presented) The method according to claim 1, wherein the silicon powder in process steps b) - f) comprises silicon powder with a grain diameter of 40 - 90 μm .

3. (Previously Presented) The method according to claim 1, further comprising splitting the energy beam before the zone of incidence with the workpiece surface into a first part beam and a second part beam, wherein the first part beam is deflected into the heating front and melting bath and a second part beam is deflected behind the solidification front after the first part beam for thermal structural treatment.

Claim 4. (Previously Presented) The method according to claim 3 wherein the second part beam is directed behind the solidification front onto the workpiece surface at a specific power of $< 1 \text{ kW/mm}^2$ to control formation of a precipitation structure in the surface-alloyed structural member.

Claim 5. (Previously Presented) The method according to claim 2 wherein the energy beam dissolves and homogeneously distributes primary precipitated Si phases in the melting bath is between 0.01 and 1 second.

Claim 6. (Previously Presented) The method according to claim 1, comprising using a ≥ 3 kW diode laser with a variable optical system to adjust the linear focal width of 4 - 15 mm to form the energy beam.

Claim 7. (Previously Presented) The method according to claim 1, comprising reducing the linear focal width of the energy beam transverse to the feed direction before the beginning and at the end of alloying.

Claim 8. (Previously Presented) The method according to claim 1, wherein the workpiece comprises a hollow cylinder which is positioned so that its longitudinal axis is transverse to the direction of gravity and which is rotated about said longitudinal axis during the alloying wherein the energy beam which is held in a fixed position relative to the direction of rotation, performs a continuous feed movement during the rotation in the direction of the axis of rotation to produce a flat alloying zone.

Claim 9. (Previously Presented) The method according to claim 1 wherein at the beginning of alloying, the energy beam has a point structure and continually increases in size together with the quantity of powder until it has reached the complete linear focal width after a rotation of the workpiece.

Claim 10. (Previously Presented) The method according to claim 1 comprising continually reducing to zero the linear focal width and the quantity of powder at the end of the alloying during the last rotation of the workpiece.

Claim 11. (Previously Presented) The method according to claim 1 comprising treating along the longitudinal axis at a depth of up to 200 mm a hollow cylinder made of Al or Mg alloys having a bore diameter of 60 - 120 mm.

Claims 12-22. (Cancelled)